

# NOAA Knows... Tsunamis

Of all Earth's natural hazards, tsunamis are among the most irregular and infrequent. Yet, they pose a major threat to coastal populations, particularly in the Pacific. Although tsunamis cannot be prevented, community preparedness, accurate and timely warnings and effective response can save lives and protect property. The 2011 tsunami in Japan and the 2004 Indian Ocean tsunami have focused world attention on the rare but very real threat of tsunamis and underscored the value of a comprehensive warning system and an educated public.

A tsunami is a series of ocean waves created by a sudden displacement of seawater. Most tsunamis are caused by earthquakes, but they can also be caused by landslides, volcanic activity, meteorites and even certain weather-related phenomena. A tsunami could strike the U.S. coastline at any time and can be very dangerous to life and property when it reaches the shore. It may arrive like a fast-rising flood and can strike with devastating force. Tsunami waves can range in size from inches to more than a hundred feet high and can flood low-lying areas more than a mile inland. Waves may continue for several hours, and the first one may not be the largest.

## NOAA's Role

The NOAA Tsunami Program is a cross-NOAA cooperative effort to minimize the impacts of tsunamis. For more than 50 years, NOAA has had operational responsibility for the U.S. Tsunami Warning System. This end-to-end system, which is dependent on partnerships



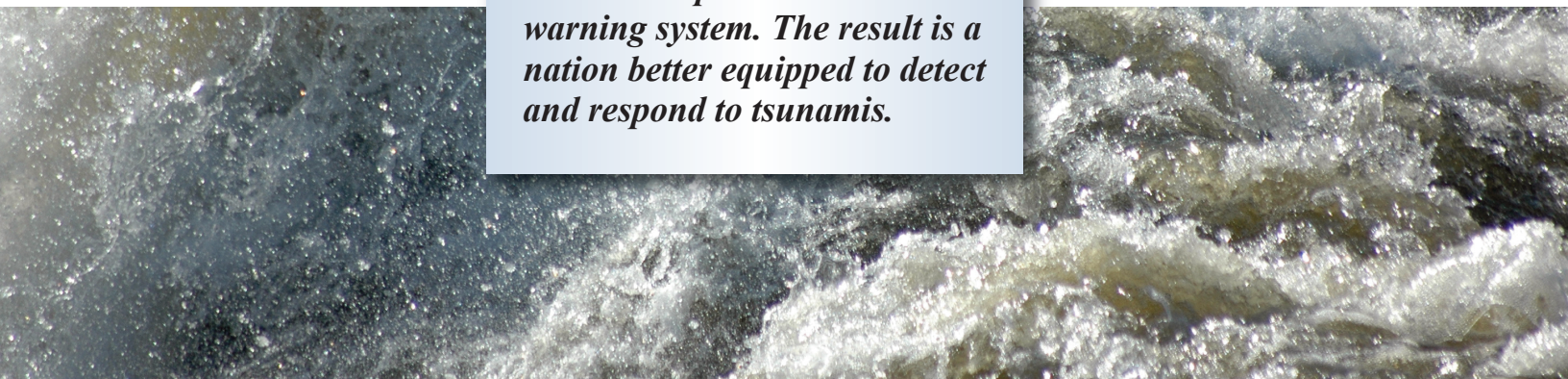
with federal, state, territorial, international, regional and local organizations, includes observations to detect a tsunami, models to forecast its path and impact, timely and accurate alerts and educational efforts to ensure proper public response.

## NOAA's Tsunami Warning Centers

NOAA operates two tsunami warning centers, which are staffed 24 hours a day, 7 days a week. The two centers are responsible for monitoring Earth's oceans for earthquakes and tsunamis, forecasting tsunami impacts and issuing tsunami alerts (information statements, watches, advisories and warnings) to emergency managers and the public.

The Pacific Tsunami Warning Center (PTWC) in Hawaii was established following a 1946 tsunami that struck Hawaii and killed more than 150 people and caused over \$300 million in damage (2014 dollars). The PTWC serves Hawaii and the U.S. Pacific territories and is the primary international forecast center for the Pacific and Caribbean Basins.

*NOAA has led the U.S. effort to build a comprehensive tsunami warning system. The result is a nation better equipped to detect and respond to tsunamis.*







In 1964, the largest recorded earthquake in U.S. history generated a number of destructive tsunamis that killed 124 people in Alaska, Oregon and California and caused approximately \$1 billion in damage (2014 dollars). This prompted the creation of the National Tsunami Warning Center (NTWC, formerly the West/Coast Alaska Tsunami Warning Center). The NTWC, located in Alaska, serves all U.S. states except Hawaii. It also serves Puerto Rico, the Virgin Islands and Canada.

NOAA has also developed inundation models that are used by coastal states and communities to create inundation maps. These maps are used to define tsunami hazard and evacuation zones and support community planning.



NOAA also maintains a global tsunami database that includes information on roughly 2,500 tsunamis from 2000 B.C. to the present. It is used to identify regions at risk, validate tsunami forecast models, help position DART buoy stations and sea-level gauges and prepare for future events.

## Preparedness and Mitigation

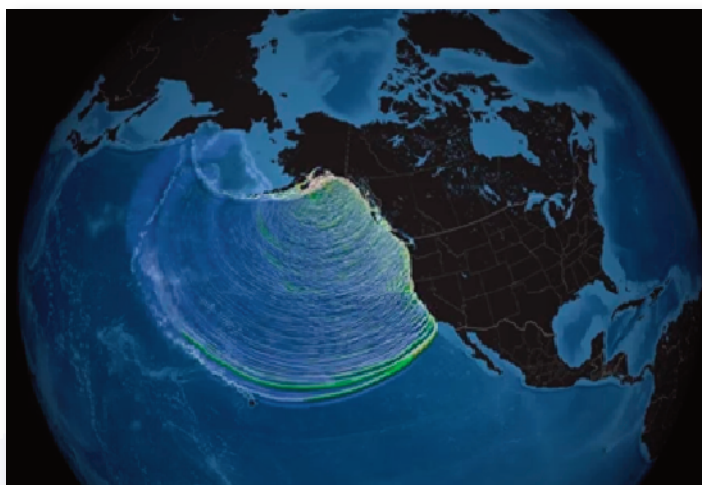
Preparedness and mitigation activities that enhance response to a tsunami threat and reduce or eliminate tsunami risk are important parts of any tsunami warning system. NOAA works with its federal, state, territorial, local and international partners to ensure that coastal communities, residents and visitors understand their tsunami risk and how to manage it and know how to respond to tsunami alerts. Inundation mapping, hazard planning and outreach and education are critical preparedness and mitigation activities.

## International Coordination

The NOAA Tsunami Program also plays a vital role in the global tsunami warning system based on its United Nations-directed mission to provide tsunami information throughout the Pacific and Caribbean Basins. NOAA monitors international tsunami warning activities; provides international warning, training, data exchange and outreach and education assistance; and uses international data, communications and research to carry out its mission, both internationally and domestically.

Learn more about the NOAA Tsunami Program and tsunamis at <http://www.tsunami.gov/>.

To learn more about NOAA, visit <http://www.noaa.gov/>. 



*This image is a snapshot from an animation of the large tsunami generated in Alaska's Prince William Sound in 1964. Credit: NOAA/PTWC.*

## Observations and Models

NOAA has established and maintains two essential sea-level observation networks: a network of Deep-Ocean Assessment and Reporting of Tsunamis (DART) buoy stations and an extensive array of coastal sea-level gauges. These networks are monitored by scientists at the warning centers as part of a detection system that also includes global sea-level and seismic networks. Seismic networks help determine the location and magnitude of earthquakes. The open ocean DART buoy stations and coastal sea-level gauges help detect and track tsunamis and estimate coastal impacts.

NOAA has developed tsunami forecast models for U.S. coastal communities at high risk for tsunamis. If an earthquake occurs that may cause a tsunami, the scientists use these models and the data from the seismic, DART buoy station and sea-level gauge networks to project wave height and arrival times and determine which tsunami alerts to issue, if any, and where.